

Preventive Maintenance and Repair

Elevators: Electric traction and Hydraulic

1 SCOPE

- 1.1 The Contractor agrees to provide skilled competent employees trained by the elevator manufacturer or an accredited elevator apprentice program for the purpose of maintenance and repair of elevators, dumbwaiters, accessibility lifts, and material lifts as defined in ASME 17.1 Safety Standard for Elevators and Escalators. Maintenance shall include monthly preventive maintenance, repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required for operation as designed. Only parts and supplies recommended by the original equipment manufacturer shall be installed.
- 1.2 Other services to be provided by the contractor include:
 - 1.2.1 24 hour call back service. Entrapments or accidents involving vertical transportation equipment are an emergency call back, as is a condition where all units are out of service. These calls should have a 1 hour maximum response time. Other call backs should carry a maximum response time of 24 hours.
 - 1.2.2 Periodic inspection and tests. Annual “No-Load” Safety Tests and Five Year “Full Load” Safety Tests in accordance with ASME 17.1. The contractor shall provide all necessary procedures, labor, testing equipment and test weights.
 - 1.2.3 Maintenance Control Plan. The contractor shall provide a maintenance control plan to include all units.
 - 1.2.4 Disposal of hazardous materials in accordance with contract and local regulations.
 - 1.2.5 Firefighters emergency operations monthly operation, including documentation.
 - 1.2.6 Examination and testing of underground hydraulic systems.
- 1.3 Regulation:
 - 1.3.1 ASME A17.1 Safety Standard for Elevators and Escalators
 - 1.3.2 ASME A17.2 Guide for Inspections of Elevators, Escalators, and Moving Walks
 - 1.3.3 ASME A17.2 Safety Code for Existing Elevators and Escalators
 - 1.3.4 15 FAM 660 Elevator Management Program

2 OWNERS RESPONSIBILITIES

- 2.1 Main line disconnects shall be of the enclosed type: circuit breaker or properly fused and provided with a lock out feature.
- 2.2 Machine rooms, pits and other equipment rooms must be kept locked.
- 2.3 Control of keys as required by ASME A17.1, Section 8.6.10.3.
- 2.4 Machine rooms and pits shall have proper illumination. Pit lights shall be guarded. Convenience outlets equipped with GFCI shall be furnished.
- 2.5 Class ABC fire extinguishers are required in machine room. See ASME A17.1, Section 8.6.1.6.5.
- 2.6 Car top exits must be able to open from outside only.

- 2.7 Side exits, where provided, must be arranged so the door can be opened from inside the car only by a special removable key and from outside the car by a non-removable handle. Side exits shall be equipped with contacts. Keys shall be stored as specified in Paragraph 4.3.
- 2.8 Repair and replacement of door panels, frames, fixtures and their appurtenances, car interiors and lighting, as well as damages including misuse and vandalism and shall be promptly corrected through coordination with the maintenance contractor.
- 2.9 Equipment room environment shall be maintained as specified by the equipment manufacturer.
- 2.10 Smoke detectors etc. for firefighters' service and main line disconnecting means where sprinklers are provided in elevator spaces.
- 2.11 Identification:
 - 2.11.1 Test tags and seals must be in place.
 - 2.11.2 Rope tags (and resocketing tags) shall be furnished as required.
 - 2.11.3 Ensure machine room code data sign, crosshead data plate, buffer data plates, etc. are provided in accordance with the applicable codes. Data plates shall be updated to list any alterations.
 - 2.11.4 Ensure all landings are properly illuminated.
 - 2.11.5 Communication systems.
 - 2.11.6 Hoistway door unlocking device key(s) shall be stored as specified in Paragraph 4.3.

3 ELEVATOR CLEANLINESS

- 3.1 Car top shall be free of debris, lint and lubricants. Pans, securely fastened in place, shall be provided under the door operator and rope hitches, if necessary. Assessment of cleanliness shall be based on minimum fire hazard and freedom from lubricant and dirt that could be tracked through the building or could constitute an unsafe surface for a person on the car top. A vacuumed surface free from lubricants shall be satisfactory. Material must not be stored on the car top. All equipment on the car top, including flexible cords, must be securely fastened to prevent snagging or falling from the car.
- 3.2 Pit area shall be dry and free from rubbish or lubricants. Rusted pit equipment shall be cleaned and painted or replaced if severely damaged. See ASME A17.1, Section 8.6.4.7.
- 3.3 Hoistway, Rails and Counterweight: Dirt, lint and excess oil in hoistway, particularly on the rails, shall be removed. The counterweight, the rear of sills and headers shall be clear of dirt accumulation. The bottom and sides of the car shall be free of oil and lint.
- 3.4 Machine Room and Equipment: The floor shall be "broom" clean. Selectors and controllers shall be cleaned to remove any accumulation of dirt or lubricants. Electronic components and printed circuit boards may be damaged by cleaning with a blower or compressed air. Follow the manufacturers' procedures.

- 3.4.1 Machines, motors and generators shall be clear of oil leakage, dirt and carbon dust. Some lubricant leakage is normal; however, it shall not be allowed to accumulate.
- 3.4.2 Foreign matter collected on the windings may damage insulation, reduce air flow and eventually result in a burn out, shorts or grounds. Oil and carbon dust that is allowed to accumulate in commutator slots will inhibit proper commutation and may result in bar to bar shorts.
- 3.4.3 Storage Cabinets and areas shall be neat and organized. Storage of soiled wipers (rags) shall be discouraged. The tops of lubricant cans shall be clean and all containers shall be closed by properly fitting covers.

4 ELEVATOR LUBRICATION

- 4.1 Lubricants and schedules recommended by the equipment manufacturer shall be used, unless an engineering evaluation of alternate products has been conducted. Ensure that proper lubrication schedules are being used. Lubricants shall be clean, not gummy or thickened. Grease shall be soft.
- 4.2 Guide shoe pivots and stems shall be free to move.
- 4.3 Rails used with roller guides shall be dry.
- 4.4 Rails used with slide guides must use a lubricant compatible with the safeties.
- 4.5 Rails must be free of oxidized lubricant in the area where the safety jaws apply.
- 4.6 Rail blades shall not be painted when "B" Type safeties are used.
- 4.7 Hoist ropes shall be clean and lubricated in accordance with manufacturer's specifications.
- 4.8 Manufacturers recommended lubricant shall be used on non-metallic sheave liners.
- 4.9 Brake cores and pivots shall be lubricated per manufacturer's specifications.
- 4.10 Governor ropes shall not be lubricated in the field.
- 4.11 Car safety linkage, governor tension frame and sheaves shall be friction free.
- 4.12 Sleeve bearing 2:1 sheaves shall be carefully examined for proper lubrication.
- 4.13 External gears shall be examined for proper lubrication.
- 4.14 Oil rings and chains must turn and carry oil.
- 4.15 Worm gears must carry oil.
- 4.16 Machine roller and ball bearings shall be lubricated per manufacturer's specifications.

5 ELEVATOR DOOR OPERATION

- 5.1 Adjustment:
 - 5.1.1 Door system masses must be considered when adjusting the door closing speed to ensure compliance with ASME A17.1 Code requirements. Closing force must be 135 N (30 lb.) or less. The doors shall open and close smoothly, quietly and without slamming. All installed door reopening device(s) shall be fully functional. Reversal shall occur with minimum stroke of safety edge. Light ray shall be operative. Electronic

devices shall provide sufficient range to reverse door with out physical contact.

5.2 Noise Levels:

- 5.2.1 Rattles and squeaks in the door operator linkage and hangers shall be investigated and corrected. Fastenings of drive arms, clutch or vanes shall be tight. Pivots and joints shall be free from excessive wear and be properly lubricated.

5.3 Mechanical System:

- 5.3.1 Door gibs, on both car and hall doors shall be securely fastened, have minimum wear, ¼ in. (6.4 mm) sill engagement and equipped with safety tabs. Check for worn sill grooves and doors that rub together.
- 5.3.2 Door rollers and tracks shall be clean, rust free and lubricated as specified. Rollers with loose tires, flat spots, or bad bearings shall be replaced.
- 5.3.3 Up thrusts shall prevent the doors from jumping the track but shall not ride the track. Up thrust roller to track clearance shall not exceed 0.015 in. (0.4 mm). Fastenings shall be locked and rollers must turn freely.
- 5.3.4 Hoistway door closers shall ensure full door closure of the stopped door from any position. Spirator or weight troughs must be tightly fastened and cords (cables) shall have no abrasion or broken wires.
- 5.3.5 Rough tracks shall be made smooth or be replaced.
- 5.3.6 Relating cables, chains, arms or racks and their fastenings must be tight. Cables with excessive broken wires or abrasion shall be replaced. Sheaves shall turn freely. Inspect for worn sheave grooves and stamped sheaves that are separating.
- 5.3.7 Hydraulic door checks shall be adjusted to avoid slamming. Some checks function in both the open and close direction. Checks shall be filled to the proper level with the fluid recommended by the manufacturer. Excessive oil leakage shall be corrected and leakage shall be cleaned up.

5.4 Door Operator and Motor:

- 5.4.1 The door operator shall be reasonably clean. Lubricants shall be in accordance with the manufacturer's instructions, including oil levels. Oil leaks must be at a minimum since damage to the inside canopy finish may result.
- 5.4.2 Motor brushes shall be free in the holders and of sufficient length to avoid commutator damage.
- 5.4.3 Excessive gear backlash and loose or worn belts shall be adjusted or shall have worn parts replaced. All bearings shall be quiet and "fits" shall be tight. Loose set screws, pins or keys shall be corrected.

5.5 Car Door Contact:

- 5.5.1 The car door contact must make reliably. For automatic elevators, the contact shall be adjusted to limit the clear open space to 2 in. (51 mm) or less. The contact location and design must comply with the ASME A17.1 Code.

5.6 Hoistway Door Interlocks:

- 5.6.1 Interlocks must be properly maintained to ensure safe and reliable elevator operation.

- 5.6.2 Contacts shall be free from pitting or burning, wiring connections must be tight and in good condition. The mechanical pivots, engaging rollers and linkage shall operate freely and be lubricated as required. Worn or damaged rollers and linkage shall be repaired or replaced.

6 ELEVATOR FIXTURES, INDICATORS, AND BUTTONS

- 6.1 Buttons and Key switches:
 - 6.1.1 Shall have the correct legible markings.
 - 6.1.2 Must not stick or be plugged.
 - 6.1.3 Damaged buttons shall be replaced.
- 6.2 Indicators and Signals:
 - 6.2.1 Indicator lamps shall illuminate as required. The use of neon lamps, LED or other long life light sources shall be encouraged.
 - 6.2.2 Broken lenses shall be replaced.
 - 6.2.3 Audible indicators shall function.
- 6.3 General:
 - 6.3.1 Face plates shall be in place and mounted square or plumb.
 - 6.3.2 Fastening screws shall be of the proper type.
 - 6.3.3 Missing screws shall be replaced.

7 ELEVATOR CONTROL SYSTEM

- 7.1 General:
 - 7.1.1 Acceleration and stopping shall be smooth and within the design limitations.
 - 7.1.2 Controller components shall be clearly identified as shown on wiring diagrams.
- 7.2 Safety Devices:
 - 7.2.1 Safety circuits must be fully operational. It is absolutely necessary to test each and every part of this circuit. Particular attention shall be given to the interlocks and car door contacts. Hoistway limits and terminal slowdowns shall have rollers in good condition and turn freely. Mechanically driven speed and position sensors shall be provided with means to detect mechanical failures.
 - 7.2.2 Static motion control systems have additional protection requirements. Ensure that they comply with code requirements.
 - 7.2.3 Fuses shall be of the proper type and rating as listed on the controller or as listed on the wiring diagram. Time delay fuses shall be used only in the circuits, where specified. Renewable link fuses are not recommended. Wire jumpers must not be installed.
- 7.3 Switch Gear:
 - 7.3.1 Contacts shall not be excessively worn and have adequate contact pressure to ensure reliable operation. Pitted contacts shall be dressed or replaced.

- 7.3.2 Shunts must be flexible. Insulation on conductors and end attachments must be in good condition, no broken wires or cracked or hardened sections.
- 7.3.3 Switches or contacts shall not be blocked. Residual guards and shading coils shall not be damaged. Pivot points or pins shall be clean and lubricated as directed by manufacturers standards. Kickoff springs in place, not stretched. Discolored encapsulated relays or switches, shall be examined for mechanical or electrical damage.
- 7.3.4 Overload relays shall be tagged indicating test dates and operation parameters. Oil dashpots shall be filled to the specified levels with the recommended fluid. Ensure that the pistons are free to move.
- 7.3.5 Switch gear shall operate quietly and smoothly and shall pull in and drop out properly.
- 7.4 Selectors and Positioning Devices:
 - 7.4.1 Selector traveling cables and all movable wiring must be flexible. All terminations shall be secure with insulation and connections in good condition.
 - 7.4.2 Selector brushes and contacts shall be examined for wear or pitting and be replaced as necessary.
 - 7.4.3 Examine mechanical condition of selectors for bearing wear or failure. Keys and set screws must be tight. Examine for looseness and fretting.
 - 7.4.4 Gears, guides and chains must be lubricated, free from rust and evidence of cutting (scoring). Drip pans shall be provided where necessary.
- 7.5 Mechanical Condition:
 - 7.5.1 All connections shall be examined for tightness and indications of heating.
 - 7.5.2 Controller and selector shall be clean as listed in Paragraph 6.4.
 - 7.5.3 Resistors and grids must not be patched. Bands must be properly placed and free from burning. Examine wiring for insulation charring.
 - 7.5.4 Resistors and capacitors must be securely and properly mounted to ensure proper heat dissipation. Resistors and capacitors that are mechanically or electrically damaged shall be replaced. Wiring, both field and internal shall be neat and bundled. Temporary wiring shall not be used. Terminal blocks shall be labeled.
- 7.6 Traveling cables shall be in good condition. Minor abrasion may be taped or repaired. Guide wires, beam pads or screens shall be provided if conditions warrant. Traveling cable attachments must be secure.
- 7.7 Wiring Diagrams:
 - 7.7.1 Wiring diagrams shall be available, be reasonably clean and in good condition and must match the controller. Changes shall be clearly marked.

8 ELECTRIC ELEVATOR MECHANICAL CONDITION AND ADJUSTMENT

- 8.1 Worms and Gears:
 - 8.1.1 Shall not show abnormal wear, no ridging or scored teeth.
 - 8.1.2 Bearings shall run quietly.
 - 8.1.3 Some leakage of worm shaft seals is acceptable.

- 8.1.4 Gland packing shall have controlled leakage.
- 8.1.5 Bearings or gears that run at a high temperature shall be investigated.
- 8.2 Drive, Deflector and Secondary Sheaves:
 - 8.2.1 Excessive groove wear or damage shall be corrected.
 - 8.2.2 Keys and or shrink fits shall not show fretting (rust or corrosion)
- 8.3 Brake Pulley and Coupling:
 - 8.3.1 Fits to shafts shall be secure, no fretting at the interface.
 - 8.3.2 Flexible couplings shall be tight, all pins and bushings securely in place. Pulley surface shall be smooth, with no excessive scoring.
- 8.4 Brake:
 - 8.4.1 Brake switch, if furnished, shall be adjusted to properly open and close the contacts.
 - 8.4.2 The linings shall not be worn to the extent that the rivets touch the drum.
 - 8.4.3 Brake shoes shall have minimum lift without dragging.
 - 8.4.4 Ensure full lift is consistent.
 - 8.4.5 Brakes to be adjusted to comply with code requirements.
- 8.5 Motors and Generators:
 - 8.5.1 Bearings shall run quietly.
 - 8.5.2 DC motor field coils shall not have excessive movement.
 - 8.5.3 Electrical connections shall be tight. Look for discoloration.
 - 8.5.4 Armature or rotor clearances shall be approximately equal throughout their circumference. Commutators shall run true. Undercutting shall provide clean slots without feather edge mica. Scoring or grooving, if any, shall be at a minimum.
 - 8.5.5 Brushes must be free in holders. Inspect for damage, copper embedment and short brushes.
 - 8.5.6 Pin point sparking is normal during acceleration and stopping. Severe arcing shall be investigated.
 - 8.5.7 Insulation resistance must be monitored to ensure proper life of electrical equipment. The minimum resistance permissible depends upon the operating voltage and temperature. Wet conditions will reduce insulation resistance as will high humidity. Any leakage to ground less than 1 megaohm needs to be investigated. The use of high voltage meggers or high voltage pulse tests is not recommended. Such testing may result in insulation damage that cannot be readily detected. In most cases, the windings can be field cleaned to restore proper insulation resistance. In extreme cases, the equipment may have to be removed to a qualified shop for steam cleaning, dipping and baking. Care must be taken when painting windings in the field to avoid sealing in lubricants or carbon dust.
- 8.6 Sound Isolation, kick angles, etc.:
 - 8.6.1 Sound isolation pads shall be pliable. Check for disintegration, splitting or cracking.
 - 8.6.2 Kick angles and tie downs shall be properly in place.
- 8.7 Ropes and Compensating Means:
 - 8.7.1 Hoist and compensating ropes shall be equalized.

- 8.7.2 Fastenings must be of an approved type and ends made up as directed by applicable codes.
- 8.7.3 Rope data tags, including resocketing tags for drum machines, are required.
- 8.7.4 Governor ropes must not be lubricated.
- 8.7.5 Wear and wire breaks within limits. Inspect ropes as specified by ASME A17.1.
- 8.7.6 Hoist ropes shall be clean to permit inspection, lightly lubricated to reduce abrasion and corrosion, yet must provide adequate traction, without slippage.
- 8.7.7 Hoist ropes may be restricted from turning as outlined in the ASME A17.1.
- 8.7.8 Compensating means shall be examined for damage and for proper attachment.
- 8.7.9 Check run-by's and clearances for code compliance.
- 8.8 Compensating Sheave Assembly:
 - 8.8.1 Tie down compensation must be properly operating, if furnished.
 - 8.8.2 Examine compensating sheave for freedom of movement and uneven grooves. The switch must operate within the limits of compensating sheave travel.
- 8.9 Oil buffers shall be filled with the manufacturer's specified fluid to the indicated level. Ports shall be covered. Buffer pistons shall be rust free and be provided with corrosion protection. Examine all buffers for full extension. Traveling buffers shall not be pre-compressed.
- 8.10 Buffers shall be properly located and securely fastened in place.
- 8.11 All moving parts of safety mechanisms shall be kept lubricated and free of rust and dirt. The clearance between the safety jaws and the rail shall comply with the applicable code requirement.
- 8.12 Governors system:
 - 8.12.1 Governor shall be kept clean. Jaws shall operate freely and must be clear of obstructions. Rope lead shall be aligned to the jaws. Linkages shall be lubricated and operate freely. Gears, set screws, keys, pins and bearings must have correct fits and minimum wear or backlash. Sheave groove shall be free of foreign matter. Check depth of groove wear that may cause rope to interfere with jaw engagement.
 - 8.12.2 Governor adjustments shall be sealed to prevent tampering. Test tags shall be in place indicating the date of the last test and the person or firm who made the test.
 - 8.12.3 A governor marking plate as required by the applicable code, securely attached to the governor shall list: The tripping speed in feet per minute. The size, material and construction of the governor rope.
 - 8.12.4 Ensure the paint does not interfere with governor operation.
 - 8.12.5 Governor switches shall operate as intended, both mechanically and electrically.
 - 8.12.6 Fly ball governors must clear obstructions that may prevent full extension of the flyballs.

- 8.12.7 Car rope hitches must be socketed correctly. Rope data shall be furnished.
- 8.12.8 Governor ropes must not be lubricated.
- 8.12.9 Governor rope tension frame shall be free to move vertically with rope tensioned as designed. Hold downs shall be adjusted to suit job conditions. Sheave bearings shall be quiet, wear limited to sheave clearance and tolerance. Sheave groove must be free of foreign matter.
- 8.13 Rails and Brackets:
 - 8.13.1 Rail bracket fastenings shall be tight. Masonry walls supporting rail brackets must be structurally sound.
 - 8.13.2 Rail clip bolts must be tight. Sliding clips must be free to move. Sliding clips of the type backed with spring steel clips must be examined for missing or broken spring clips. Fishplate bolts must be tight. Rail backing must be securely fastened.
 - 8.13.3 Check rails for alignment. Building settlement may transfer building load to guide rails.
 - 8.13.4 Check counterweight rails for bracket spacing and spreader brackets, particularly in the pit area.
 - 8.13.5 Rail blades shall be rust free. Blades shall not be painted when Type B safeties are used. Refer to Paragraphs 7.4 and 7.5 and crosshead data plate for lubrication and blade condition.

1. Elevators Inventory:

a. "Passenger Elevator 1"

Name: "Elevator H404470"
 Date of Install: "10/2006"
 Manufacturer: "KONE"
 Capacity: "1800 kg"
 Speed: "1 m/s"
 Drive Type: "Overhead traction"
 Date of Last
 Inspection: "4/20/2015"
 Known Issues: "None"

b. "Passenger Elevator 2"

Name: "Elevator H404471"
 Date of Install: "10/2006"
 Manufacturer: "KONE"
 Capacity: "1600 kg"
 Speed: "1 m/s"
 Drive Type: "Overhead traction"
 Date of Last
 Inspection: "4/20/2015"
 Known Issues: "None"